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Fit for Purpose

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Abstract
Packaged food and beverages are commonly used hospital environments for single serve portion control, convenience and cost savings (Rechbauer 2013). Older adults occupy almost half of Australian hospital beds and this percentage will increase with the corresponding ageing of the general population (Australian Institute of Health and Welfare 2017). The provision of packaged hospital food service to these older adults is relevant as researchers have estimated that 40% of UK hospital patients were malnourished with 60% at risk, with the. . .' average food intake less than 75% of that recommended, particularly among the elderly' (Schenker 2003). In fact, studies have shown that older patients are five times more likely to be at risk of malnutrition than younger patients (Lazarus 2005, Banks 2007, Vivanti 2008).

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Ageing; food packaging; hospital; assessment; design.

Introduction

Packaged food and beverages are commonly used hospital environments for single serve portion control, convenience and cost savings (Rechbauer 2013). Older adults occupy almost half of Australian hospital beds and this percentage will increase with the corresponding ageing of the general population (Australian Institute of Health and Welfare 2017). The provision of packaged hospital food service to these older adults is relevant as researchers have estimated that 40% of UK hospital patients were malnourished with 60% at risk, with the. . .' average food intake less than 75% of that recommended, particularly among the elderly' (Schenker 2003). In fact, studies have shown that older patients are five times more likely to be at risk of malnutrition than younger patients (Lazarus 2005, Banks 2007, Vivanti 2008).

A malnutrition prevalence study highlighted the difficulty experienced by patients in opening food and beverage packaging with a number of these patients indicating that they did not eat the food because they could not open it (Mathews 2007). Further work has also identified inability to access food and beverage packaging as a contributing factor to malnutrition among the elderly and disabled in hospitals (Walton 2006, Tsang 2008). The relationship between grip strength and the difficulty to open packaging has also been investigated (Bell 2013). This study measured 140 participants (mostly elderly inpatients) and 64 staff members recruited from local public hospitals. Several food and beverage packages were found difficult to open by at least 40% of patients. These included milk and juices (52%), cereal (49%), condiments (46%), tetra packs (40%) and water bottles (40%). The authors have subsequently undertaken further work to assess the effect of dexterity, grip strength and packaging (Bell 2017) and analysing the effect of posture on packaging accessibility (Bell 2016).

The issue of poorly performing packaging was also highlighted by the NHS in the UK. In 2013, the NHS set up a taskforce to look at the problem of poorly designed single portion packaging and possibility of implementing a strategy of removing it from the supply chain. As part of this work an initial study was undertaken to assess the packaging using the user test protocol described in Annex D of ISO17480 (International Organisation for Standardisation (ISO)). This protocol was developed in response to the issues highlighted

about older people's inability to access packaging. The results of this work were first presented by Yoxall and Lecko at the Hospital Caterers Association conference in Liverpool, UK in 2016 and subsequent work by the authors is currently under review.

Work by these authors has also indicated that much of the dissatisfaction with packaging and the poor ratings that packaging receives when being assessed in protocols such as Annex D of ISO17480 is very dependant on the time taken to open the pack. Whilst much of the previous research has concentrated on user capabilities and issues surrounding loss of capabilities as people age, very little work has looked at the attributes of the packaging and the attributes of the packaging that contribute to the time taken to open the pack from an ergonomics perspective.

Hence, the work presented here is an initial study exploring the issues surrounding the relationship between time taken to open a pack and satisfaction and a basic ergonomics task analysis method. The subsequent aim is in understanding the issues around the packaging 'failure' in order to assist packaging designers, brand owners and manufacturers to 'design out' some of the ergonomic issues relating to the poor performance of packaging.

Methods

The method used to assess the packs was similar to that proposed by the User Panel Test method CEN15945 (2011) and Annex (D) of ISO 17480 (2015). Participants are asked to familiarize themselves with each packaging item and then subsequently attempt to open the packaging. For the purposes of this research participants were asked to only give a rating of their overall satisfaction on the opening experience. Packaging is rated on a Likert scale (the scale is defined in the standard). For the purposes of a pass or fail of the pack the ratings of "Extremely Dissatisfied", "Dissatisfied" etc., are converted to a score (1 for "Extremely Dissatisfied", and 5 for "Extremely Satisfied"). A pack is recorded as a failure if within the 20 people cohort there is an example of pack being unable to be opened within the time limit (defined as 1 minute) or the overall satisfaction score ranks below 3 ("Satisfied"). The test can be repeated on another cohort if there is a likelihood that the number of failures will remain below a specified number or the likelihood of a score of 3 ("Satisfied") can be attained. The test stops completely when the number of participants reaches 100. In addition, a basic task analysis process determined the number of actions required by the user to access the pack contents. The packs tested are in Table 1.

Table 1. Items selected for initial testing

Item	Pack Description
Jam	Single portion polymer lid/forming
Fruit Pot	Polymer lid/ polymer pot
Orange Juice	Aluminium/Polymer lidded polymer pot
Jelly	Aluminium/Polymer lidded polymer pot
Cheese	Single portion shrink-wrap polymer
Crackers	Double portion flow wrap
Milk	Single portion polymer lid/ jigger
Biscuits	Double/Treble portion flow wrap
Spread	Single portion polymer lid/forming
Sandwiches	Standard triangular carton skillet

Table 2 shows the mean opening time (sec), the number of pack failures (unopenable packs, mean score), the overall pass/fail and the number of actions required to open each pack. The results indicated that seven of the ten packs tested failed the ISO standard panel test. Five packs, the jam, fruit pot, cheese, and the biscuits failed due to participants being unable to open the contents in the allotted time; with crackers, milk and sandwiches failing due to being rated below 3 'Satisfactory.'

This initial study showed a high correlation between time taken to open the pack and low satisfaction, including giving up opening the pack. The time taken to open a pack is complex, linked to the users expectation of the time to open a pack compared to the actual time, the user's ability (dexterity, strength and cognition) and pack properties. This study is an initial attempt to look at the relationship between the attempts to open a pack versus satisfaction. The results indicate that packs with a high degree of subtasks (such has sandwiches) and packs that require high levels of manipulation are more likely to fail than packs with minimal subtasks/manipulation.

Item *(n)=20*	Mean Time To Open S (SD)	Number of failures	Mean Score	Pass/fail
Jam	10.89 (9.01)	3	3.0	Fail
Fruit Pot	10.50 (6.46)	3	2.86	Fail
Orange Juice	5.14 (2.79)	0	4.79	Pass
Jelly	4.37 (2.00)	0	4.64	Pass
Cheese	15.51 (7.91)	6	1.92	Fail
Crackers	16.6 (9.40)	4	2.85	Fail
Milk	8.42 (4.34)	0	2.43	Fail
Biscuits	9.62 (3.48)	2	3.43	Fail
Spread	3.45 (2.00)	0	4.64	Pass
Sandwiches	16.73 (7.84)	0	2.86	Fail

Table 2. Pack time to open, satisfaction score and rating

Previous research by Bell has found similar results for the same packs with effective pack opening associated strongly with higher levels of dexterity (Bell 2016, 2017). The design of the pack demanding high levels of dexterity from the user, either because of the number of actions required to open the pack, or due to the small and 'fiddly' access points on the pack.

Conclusion

As the population ages, older patients with multiple health issues will become the default patient. In the community, single older person household numbers will increase, expanding on a willing market for packaged products for convenience and to limit food waste (Joutsela 2015). Designers and manufactures can successfully cater for this growing market by adopting principles of universal design: 'The design of mainstream products…that are accessible to, and usable by, as many people as reasonably possible ….without the need for special adaptation or specialised design' (British Standards Institute (British Standards Institute 2005)). Utilising the User Panel test method and undertaking simple ergonomics analyses such as task analysis are techniques that can assist the iterative design process for food and beverage packs to improve openability and capture this emerging growth market.

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